

CLAIMS

1. A method for producing a yarn consisting of numerous filaments, using:

5 (a) a spinneret having numerous spinning holes to discharge a flowable polymer continuously for forming filaments,

(b) a spinning tube having a filament passage through which the numerous filaments formed by said numerous spinning holes run downward from said spinneret, and installed below and spaced from  
10 said spinneret,

(c) an oiling means for applying an oil to the numerous filaments coming out of said spinning tube,

(d) a filament take-up means for taking up the numerous filaments coming from said oiling means, and

15 (e) a winding means for winding the numerous filaments coming from said filament take-up means,

characterized in that

(f) gas injection holes are provided, which inject gas obliquely downward from outside the numerous filaments entering  
20 the filament passage of said spinning tube, toward the numerous filaments, while the numerous filaments are still flowable, to ensure that the numerous filaments can be disposed along one straight line or one circle without overlapping each other, and further to ensure that, subsequently after disposing the numerous  
25 filaments, the injected gas can form a gas stream flowing downward together with the numerous filaments in the filament passage of

said spinning tube, and

(g) the velocity of the gas stream flowing downward together with the numerous filaments in the filament passage of said spinning tube is not less than 60% of a take-up speed of the numerous filaments taken up by said filament take-up means.

2. A method for producing a yarn, according to claim 1, wherein said numerous filaments are disposed along one straight line; the cross sectional form of the filament passage of said spinning tube is rectangular; the direction of the long sides of said rectangle agrees with the direction of said straight line; and the following relation is satisfied

$$d \times 3 \leq Ex \leq d \times 20$$

where  $Ex$  is the length of the short sides of said rectangle, and  $d$  is the diameter of said spinning holes.

15 3. A method for producing a yarn, according to claim 2, wherein said numerous spinning holes are arranged in straight lines; and the number of the straight lines is 3 or less.

4. A method for producing a yarn, according to claim 1, wherein the following relation is satisfied:

$$La \leq Lg/2$$

20 where  $Lg$  is the distance between said spinneret and the position at which said numerous filaments are solidified to lose their flowability and reach the take-up speed of the numerous filaments taken up by said filament take-up means, and  $La$  is the distance between said spinneret and the position at which the acceleration of said numerous filaments becomes largest.

5. A method for producing a yarn, according to claim 4, wherein  
the velocity of the gas stream flowing downward together with said  
numerous filaments in the filament passage of said spinning tube  
is higher than the running speed of said numerous filaments in  
5 the range of the distance  $L_g$  between said spinneret and the position  
at which the running speed of said numerous filaments reaches the  
take-up speed of the numerous filaments taken up by said filament  
take-up means.

6. A method for producing a yarn, according to claim 1, wherein  
10 a gas suction and discharge means for sucking and discharging gas  
existing around the numerous filaments running from said spinning  
holes toward said filament passage is installed between said  
spinneret and said spinning tube, to ensure that the gas existing  
around said numerous filaments can be sucked and discharged.

15 7. A method for producing a yarn, according to claim 6, wherein  
the numerous filaments are disposed along one straight line; the  
cross sectional form of the filament passage of said spinning tube  
is rectangular; the direction of the long sides of said rectangle  
agrees with the direction of said straight line; and the following  
20 relation is satisfied

$$Ex \leq 10 \text{ mm}$$

where  $Ex$  is the length of the short sides of said rectangle.

8. A method for producing a yarn consisting of numerous  
filaments, using:

25 (a) a spinneret having numerous spinning holes formed to  
discharge a flowable polymer continuously for forming filaments,

(b) a spinning tube having a filament passage through which the numerous filaments formed by said numerous spinning holes run downward from said spinneret, and installed below and spaced from said spinneret,

5 (c) an oiling means for applying an oil to the numerous filaments coming out of said spinning tube,

(d) a filament take-up means for taking up the numerous filaments coming from said oiling means, and

10 (e) a winding means for winding the numerous filaments coming from said filament take-up means,

characterized in that

15 (f) gas injection holes are provided, which inject gas obliquely downward from outside the numerous filaments entering the filament passage of said spinning tube, toward the numerous filaments, while the numerous filaments are still flowable, to ensure that the numerous filaments can be disposed along one straight line or one circle without overlapping each other, and further to ensure that, subsequently after disposing the numerous filaments, the injected gas can form a gas stream flowing downward together with the numerous filaments in the filament passage of said spinning tube, and

20 (g) the following relation is satisfied:

$$La \leq Lg/2$$

where  $Lg$  is the distance between said spinneret and the position  
25 at which said numerous filaments are solidified to lose their flowability and reach the take-up speed of the numerous filaments

taken up by said filament take-up means, and La is the distance between said spinneret and the position at which the acceleration of said numerous filaments becomes largest.

9. A method for producing a yarn, according to claim 8, wherein  
5 the velocity of the gas stream flowing downward together with said numerous filaments in said filament passage is higher than the running speed of said numerous filaments.

10. A method for producing a yarn consisting of numerous filaments, using:

10 (a) a spinneret having numerous spinning holes formed to discharge a flowable polymer continuously for forming filaments,

15 (b) a spinning tube having a filament passage through which the numerous filaments formed by said numerous spinning holes run downward from said spinneret, and installed below and spaced from said spinneret,

(c) an oiling means for applying an oil to the numerous filaments coming out of said spinning tube,

(d) a filament take-up means for taking up the numerous filaments coming from said oiling means, and

20 (e) a winding means for winding the numerous filaments coming from said filament take-up means,

characterized in that

25 (f) gas injection holes are provided, which inject gas obliquely downward from outside the numerous filaments entering the filament passage of said spinning tube, toward the numerous filaments, while the numerous filaments are still flowable, to

ensure that the numerous filaments can be disposed along one straight line or one circle without overlapping each other, and further to ensure that, subsequently after disposing the numerous filaments, the injected gas can form a gas stream flowing downward 5 together with the numerous filaments in the filament passage of said spinning tube, and

(g) a gas suction device is provided between said spinneret and said spinning tube, to suck the gas existing around said numerous filaments and to discharge the gas outside.

10 11. A method for producing a yarn, according to claim 10, wherein the width of said filament passage in the direction perpendicular to the direction in which said numerous filaments are disposed side by side is 10 mm or less.

12. A method for producing a yarn, according to claim 10, wherein 15 the suction of the gas existing around said numerous filaments is carried out on both sides of the disposal of said numerous filaments.

13. A method for producing a yarn, according to claim 10, wherein said numerous spinning holes are arranged in straight lines; and 20 the number of the straight lines is 3 or less.

14. A method for producing a yarn, according to claim 10, wherein outside air suction spaces are formed between said gas suction device and said spinning tube, to ensure that the sucked outside air flows into said filament passage.

25 15. An apparatus for producing a yarn consisting of numerous filaments, having:

- (a) a spinneret having numerous spinning holes formed to discharge a flowable polymer continuously for forming filaments,
- (b) a spinning tube having a filament passage through which the numerous filaments formed by said numerous spinning holes run downward from said spinneret, and installed below and spaced from said spinneret,
- (c) an oiling means for applying an oil to the numerous filaments coming out of said spinning tube,
- (d) a filament take-up means for taking up the numerous filaments coming from said oiling means, and
- (e) a winding means for winding the numerous filaments coming from said filament take-up means,  
characterized in that
- (f) gas injection holes are provided, which inject gas obliquely downward from outside the numerous filaments entering the filament passage of said spinning tube, toward the numerous filaments, while the numerous filaments are still flowable, to ensure that the numerous filaments can be disposed along one straight line or one circle without overlapping each other, and further to ensure that, subsequently after disposing the numerous filaments, the injected gas can form a gas stream flowing downward together with the numerous filaments in the filament passage of said spinning tube, and
- (g) a means is provided for adjusting the injection conditions of the gas injected from said gas injection holes or adjusting the take-up speed of the numerous filaments taken up

by said filament take-up means, to ensure that the velocity of the gas stream flowing downward together with the numerous filaments in the filament passage of said spinning tube is not less than 60% of the take-up speed of the numerous filaments taken up by said filament take-up means.

16. An apparatus for producing a yarn, according to claim 15, wherein said numerous filaments are disposed along one straight line; the cross sectional form of the filament passage of said spinning tube is rectangular; the direction of the long sides of said rectangle agrees with the direction of said straight line; and the following relation is satisfied:

$$d \times 3 \leq Ex \leq d \times 20$$

where  $Ex$  is the length of the short sides of said rectangle, and  $d$  is the diameter of said spinning holes.

17. An apparatus for producing a yarn, according to claim 16, wherein said numerous spinning holes are arranged in straight lines; and the number of the straight lines is 3 or less.

18. An apparatus for producing a yarn, according to claim 15, wherein the following relation is satisfied:

$$La \leq Lg/2$$

where  $Lg$  is the distance between said spinneret and the position at which said numerous filaments are solidified to lose their flowability and reach the take-up speed of the numerous filaments taken up by said filament take-up means, and  $La$  is the distance between said spinneret and the position at which the acceleration of said numerous filaments becomes largest.

19. An apparatus for producing a yarn, according to claim 18,  
wherein the velocity of the gas stream flowing downward together  
with said numerous filaments in the filament passage of said  
spinning tube is higher than the running speed of said numerous  
filaments, in the range of the distance Lg between said spinneret  
and the position at which the running speed of the numerous filaments  
reaches the take-up speed of the numerous filaments taken up by  
said filament take-up means.

20. An apparatus for producing a yarn, according to claim 15,  
wherein a gas suction and discharge means for sucking and  
discharging the gas existing around the numerous filaments running  
from said spinning holes toward said filament passage is installed  
between said spinneret and said spinning tube, to ensure that the  
gas existing around said numerous filaments can be sucked and  
discharged.

21. An apparatus for producing a yarn, according to claim 20,  
wherein the numerous filaments are disposed along one straight  
line; the cross sectional form of the filament passage of said  
spinning tube is rectangular; the direction of the long sides of  
said rectangle agrees with the direction of said straight line;  
and the following relation is satisfied:

$$Ex \leq 10 \text{ mm}$$

where Ex is the length of the short sides of said rectangle.

22. An apparatus for producing a yarn consisting of numerous  
filaments, having:

- (a) a spinneret having numerous spinning holes formed to

discharge a flowable polymer continuously for forming filaments,

(b) a spinning tube having a filament passage through which the numerous filaments formed by said numerous spinning holes run downward from said spinneret, and installed below and spaced from  
5 said spinneret,

(c) an oiling means for applying an oil to the numerous filaments coming out of said spinning tube,

(d) a filament take-up means for taking up the numerous filaments coming from said oiling means, and

10 (e) a winding means for winding the numerous filaments coming from said filament take-up means,

characterized in that

(f) gas injection holes are provided, which inject gas obliquely downward from outside the numerous filaments entering  
15 the filament passage of said spinning tube, toward the numerous filaments, while the numerous filaments are still flowable, to ensure that the numerous filaments can be disposed along one straight line or one circle without overlapping each other, and further to ensure that, subsequently after disposing the numerous  
20 filaments, the injected gas can form a gas stream flowing downward together with the numerous filaments in the filament passage of said spinning tube, and

(g) the following relation is satisfied:

$$La \leq Lg/2$$

25 where  $Lg$  is the distance between said spinneret and the position at which said numerous filaments are solidified to lose their

flowability and reach the take-up speed of the numerous filaments taken up by said filament take-up means, and La is the distance between said spinneret and the position at which the acceleration of said numerous filaments becomes largest.

5       23. An apparatus for producing a yarn, according to claim 22, wherein the velocity of the gas stream flowing downward together with said numerous filaments in said filament passage is higher than the running speed of said numerous filaments.

10      24. An apparatus for producing a yarn consisting of numerous filaments, having:

(a) a spinneret having numerous spinning holes formed to discharge a flowable polymer continuously for forming filaments,

15      (b) a spinning tube having a filament passage through which the numerous filaments formed by said numerous spinning holes run downward from said spinneret, and installed below and spaced from said spinneret,

(c) an oiling means for applying an oil to the numerous filaments coming out of said spinning tube,

20      (d) a filament take-up means for taking up the numerous filaments coming from said oiling means, and

(e) a winding means for winding the numerous filaments coming from said filament take-up means,

characterized in that

25      (f) gas injection holes are provided, which inject gas obliquely downward from outside the numerous filaments entering the filament passage of said spinning tube, toward the numerous

filaments, while the numerous filaments are still flowable, to ensure that the numerous filaments can be disposed along one straight line or one circle without overlapping each other, and further to ensure that, subsequently after disposing the numerous 5 filaments, the injected gas can form a gas stream flowing downward together with the numerous filaments in the filament passage of said spinning tube, and

(g) a gas suction device is installed between said spinneret and said spinning tube, to suck the gas existing around said numerous 10 filaments and to discharge the gas outside.

25. An apparatus for producing a yarn, according to claim 24, wherein the width of said filament passage in the direction perpendicular to the direction in which said numerous filaments are disposed side by side is 10 mm or less.

15 26. An apparatus for producing a yarn, according to claim 24, wherein the suction of the gas existing around said numerous filaments is carried out on both sides of the disposal of said numerous filaments.

27. An apparatus for producing a yarn, according to claim 24, 20 wherein said numerous spinning holes are arranged in straight lines; and the number of the straight lines is 3 or less.

28. An apparatus for producing a yarn, according to claim 24, wherein outside air suction spaces are formed between said gas suction device and said spinning tube, to ensure that the sucked 25 outside air flows into said filament passage.